S. Kumar SOOD*: Co-existence of two types of embryogeny in *Satyrium nepalense* (Orchidaceae)

S.K. スード*: *Satyrium nepalense* (ラン科) の胚形成に見られる 2 型

Orchidaceae Juss. show considerable diversity of form and variability in embryological characters (Davis 1966, Schnarf 1931, Wirth & Withner 1959). However, the ontogenetic variability of embryo development in the same species is hitherto unrecorded in the family. The present paper describes the occurrence of two types of embryo development in the same species, *Satyrium nepalense* Don, a member of the subtribe Disinae, tribe Orchideae, subfamily Orchidoideae (Dressler & Dodson 1960).

Materials and methods Developing and mature fruits of *Satyrium nepalense* Don were collected from a single plant and fixed in formalin-acetic acid-alcohol. Conventional methods of microtechnique were followed. The sections were cut at 8–12 μm thick and stained in safranin-fast green.

Observations The first pattern of development which is preponderant shows inverted T-shaped proembryonal tetrad. Here, the zygote (Fig. 1) elongates and divides transversely to form a terminal cell *ca* and a basal cell *cb* (Fig. 2). *cb* divides transversely resulting in a middle cell *m* and a suspensor initial cell *ci* (Figs. 3, 4). Both *ca* and *m* divide by a longitudinal division (Figs. 5, 10). The two cells of *ca* undergo a longitudinal division at right angles to the first forming a quadrant which divides transversely resulting in an octant with two tiers *l* and *l′* (Fig. 10). Further divisions occur in both planes in the cells of tiers *m*, *l′* and *l* resulting first in a globular and then a mature embryo (Figs. 11–13).

In the intervening time, the *ci* undergoes transverse divisions to form a linear suspensor of five cells (Fig. 11). The uppermost suspensor cell *h′* divides vertically and forms two juxtaposed cells (Fig. 13). The derivatives of these contribute in the formation of epidermis of mature embryo. The rest of suspensor collapses shortly after the differentiation of globular embryo (Fig. 12). The embryogeny conforms to the Onagrad type.

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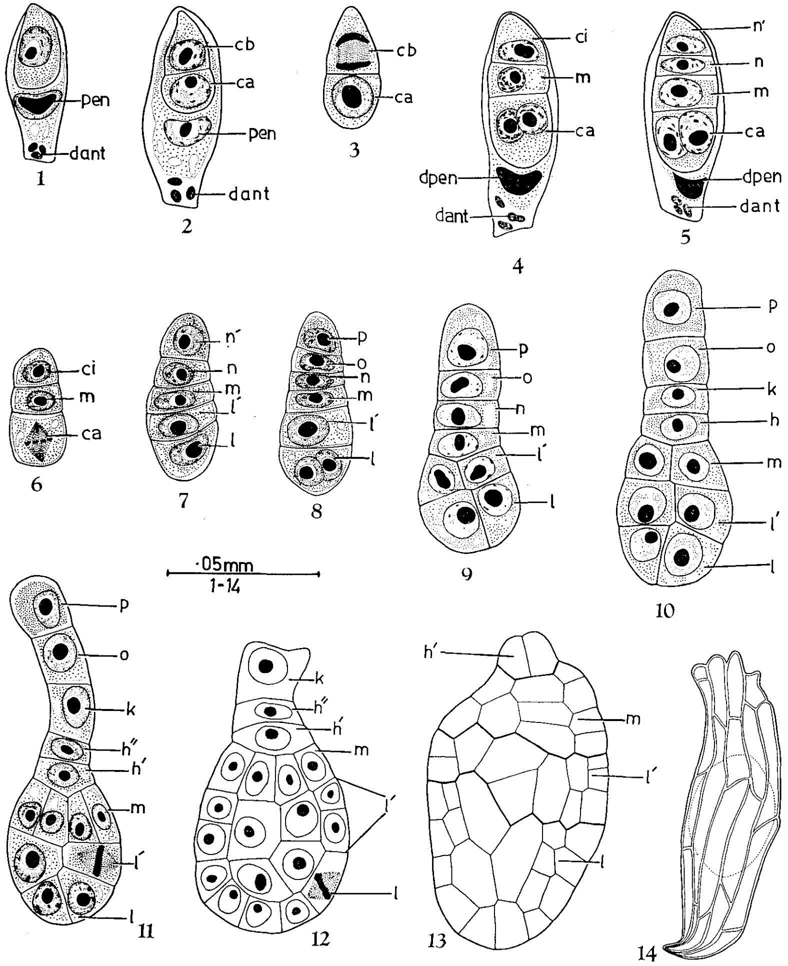

Figs. 1-14. 1: Zygote. 2: Two-celled proembryo with primary endosperm nucleus and degenerated antipodals. 3: Same; basal cell in division. 4: Same; terminal cell in division. 5: Four-celled proembryo; suspensor initial cell *ci* formed *n* and *n′*. 6: Three-celled proembryo; note the transverse division in terminal cell. 7: Five-celled proembryo. 8: Six-celled proembryo with vertically divided terminal cell. 9: Twelve-celled proembryo. 10-12: Early stages in the formation of globular embryo. 13: Maturing embryo. 14: Seed with embryo; note elongated seed coat cells. dant: degenerated antipodals. dpen: degenerated primary endosperm nucleus. pen: primary endosperm nucleus.

In the second pattern of development the sequence of divisions in some proembryos deviates from the pattern described above. Here, after the 3-celled stage of proembryo, both *ca* and *cb* divide transversely to form a five-celled linear proembryo (Figs. 6, 7). The cells of tiers *l* and *l′* undergo two longitudinal divisions oriented at right angles to each other (Figs. 8, 9). *m* also divides longitudinally (Fig. 10). Further course of the development of suspensor and the differentiation of first the globular and later the mature embryo is similar to the first pattern of development. The embryogeny corresponds to the Chenopodiad type.

Irrespective of the mode of development, the mature embryo in both the types is organized from the derivatives of *ca*, *m* and *h′*. The embryo is ovoid and undifferentiated. It has a well defined epidermis enclosing a central mass of cells. The cells contain starch. The transparent seed coat surrounds the mature embryo (Fig. 14).

Discussion and conclusions Swamy (1949) classified orchid embryogeny into Group 'A', Group 'B' and *Cymbidium* types. In Group 'A' the suspensor initial cell, middle cell and terminal cell participate in the formation of mature embryo, whereas in Group 'B' the suspensor initial cell gives rise to the suspensor while the mature embryo is organized from the derivatives of terminal and middle cells. The *Cymbidium* type is characterized by the occurrence of irregular divisions in the terminal and basal cells. Johansen (1950) classified Group 'A' and Group 'B' as 'Asterad' and 'Onagrad' types respectively. The embryogeny of *Satyrium nepalense* shows the co-existence of Onagrad (Group 'B' of Swamy 1949) and Chenopodiad types. The occurrence of Chenopodiad embryogeny and its co-existence with the Onagrad type in *Satyrium nepalense* are the first records for the Orchidaceae. As the Chenopodiad type of embryogeny has not been recognized in the classification of Swamy (1949), therefore, it is revised to accomodate it.

Type 1. The terminal cell of the 2-celled proembryo divides by a vertical wall.

Group 'A' (Asterad type): The terminal and basal cell contribute equally in the organization of mature embryo; suspensor absent.

Group 'B' (Onagrad type): The basal cell plays a minor part in the organization of mature embryo; suspensor present.

Type 2. The terminal cell of the 2-celled proembryo divides by a transverse wall.

Group 'C' (Chenopodiad type) : The basal cell and terminal cell take part in the organization of mature embryo; suspensor present.

Type 3. Group 'D'. (*Cymbidium* type) : Both the terminal and basal cells divide by irregular divisions; suspensor present.

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ラン科の *Satyrium nepalense* の胚形成には二つの型が見られる。一つは2細胞期の先端の細胞 *ca* が縦に分裂する型で，これが普通である。もう一つは稀であるが，横に分裂する型である。この考察からラン科の胚形成の分類に対する新しい提案を行った。

□Ohsawa, M. (ed.) : **Life zone ecology of the Bhutan Himalaya** 313 pp. 1987. 千葉大学生態学研究室，千葉．非売品．1985年の中部ブータン調査の報告書（英文）である。植生と自然保護，土壌と地形，気候の3章を5人の著者が分担執筆している。中部ブータンの植生帯断面の模式図が示されている。2000 m から暖温帯に入り，4000 m で森林限界に達する。採集植物のリストがついている。（金井弘夫）